

## PATENT ABSTRACTS OF JAPAN

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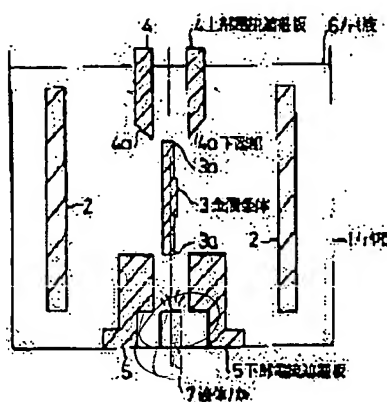
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## (54) ELECTROPLATING DEVICE

(57)Abstract:

PURPOSE: To prevent the thinning of plating at the upper end of a metallic strip when a current shielding effect and a fluidizing effect are added and to uniformize the plating thickness distribution by forming the lower end of a current shielding plate into an optimum shape.

CONSTITUTION: A specified inclination is provided to a current shielding plate 4 on both sides above a metallic strip 3 to wedge the lower end 4a. Consequently, a primary current flowing toward the upper end 3a of the strip 3 is increased. The inclination at the lower end of the current shielding plate 4 is preferably controlled to 60-80°.



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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the electroplating equipment which improves the lower limit section configuration of a current shield, and aimed at homogeneity plating.

[0002]

[Description of the Prior Art] Drawing 7 shows the configuration of the conventional electroplating equipment indicated by JP,61-45164,Y etc. This forms an anode plate 2 in a plating bath 1, and runs a cross-section lengthwise direction by carrying out the metal strip object 3 used as the negative electrode. The current shields 4 and 5 for adjusting a plating current are formed in the both sides of the upper part of the metal strip object 3, and the lower part it is made to run, respectively. Furthermore, the hydraulic nozzle 7 which blows off fluids, such as air, from between these, and flows plating liquid 6 is formed near the current shield 5 of lower both sides. In addition, lower limit section 4a of the up current shield 4 is a right angle to the side face.

[0003] By adjusting a plating current with the current shields 4 and 5 of the vertical section, hypertrophy of the plating thickness of edge 3a of the metal strip object 3 is prevented, by agitating the plating liquid 6 near the metal strip object 3 enough by the hydraulic nozzle 7, primary current distribution is equalized and equalization of plating thickness distribution is attained.

[0004]

[Problem(s) to be Solved by the Invention] However, when the current shielding effect and the convection effect were considered like the conventional technique mentioned above, it became inadequate flowing in the metal strip object upper part, and the current was easy to be covered too much, and the problem that the plating thickness of the metal strip object upper limit section became thin newly arose.

[0005] this invention person found out that fault arose, when it traced that the cause by which the plating thickness of this metal strip object upper limit section becomes thin was in the lower limit section configuration of an up current shield and the lower limit section configuration had become a right angle to the side face.

[0006] Then, the purpose of this invention is by making the lower limit section of a current shield into the optimal configuration to cancel the trouble of the conventional technique mentioned above, prevent becoming [ of the plating thickness in the metal strip object upper limit section ] thin, and offer the electroplating equipment aiming at equalization of plating thickness.

[0007]

[Means for Solving the Problem] The electroplating equipment of this invention establishes a predetermined inclination in the current shield of up both sides, and makes the lower-limit section the shape of a wedge in the gilding machine which formed the current shield which adjusts a plating current, respectively in the both sides of the upper part of a metal strip object and the lower part which makes a cross section a lengthwise direction and runs in a plating tub, and prepared the hydraulic nozzle which blows off a fluid from between the current shields of lower both sides further, and flows plating liquid. The lower limit section of a current shield becomes wedge-like by preparing a predetermined inclination.

[0008] In this case, adjustable [ of whenever / tilt-angle / of the lower limit section of the current shield of up both sides ] may be made free, or theta may be made into 60 degrees - 80 degrees whenever [ that tilt-angle ], or you may constitute so that the current shield of these up both sides may be formed horizontally free [ migration ] and it can carry out adjustable [ of the location to the metal strip object of a current shield ] further. Especially whenever [ tilt-angle ], if it is 60 degrees or less, thickness will become thick too much, if it is 80 degrees or more conversely, thickness will become thin too much, and theta was made into 60 degrees - 80 degrees, because it was not desirable.

[0009]

[Function] If an inclination is established in the current shield of the upper part of a metal strip object and the lower limit section is made into the shape of a wedge, as compared with the time of the lower limit section being a right angle, the current amount of supply and the metal ion amount of supply in the metal strip object upper part will increase. For this reason, the thinning of the plating thickness in the metal strip object upper limit section can be prevented, and plating thickness distribution of a metal strip object can be equalized.

[0010] If it makes free adjustable [ of whenever / tilt-angle / of a upside current shield ], even if plating conditions differ, whenever [ suitable for the condition / optimal tilt-angle ] can be set up easily.

[0011] If theta is especially made into 60-80 degrees whenever [ tilt-angle / of a upside current shield ], plating thickness distribution of a metal strip object can be equalized further.

[0012] If the current shield of up both sides is formed horizontally free [ migration ] and it can be made to carry out adjustable [ of the location to the metal strip object of a current shield ], even if plating conditions differ, the optimal location suitable for the condition can be set up easily.

[0013]

[Example] The example of this invention is shown in drawing 1 . This example establishes a predetermined inclination in the current shield 4 of upside both sides, and makes that lower limit section 4a the shape of a wedge. the inclination direction -- the metal strip object 3 side -- \*\* -- \*\* -- like -- the metal strip object from the anode plate 2 side upper part -- it is going caudad 3 side, and it is both current shield lower limit sections 4a and 4a, and becomes the appearance which makes reverse Ha's typeface exactly.

[0014] Thus, if lower limit section 4a of the upside current shield 4 is made into the shape of a wedge, even if a current shielding effect and the convection effect by the hydraulic nozzle 7 are considered by the current shields 4 and 5, a flow of the plating liquid 6 in the upper part of the metal strip object 3 will fully be performed, a current will be covered [ stop / \*\*\*\*\* ] too much, and the primary current will be equalized. For this reason, the problem that the plating thickness of metal strip object upper limit section 3a becomes thin is lost, and equalization of plating thickness distribution can be attained.

[0015] It actually investigated how a wedge-like tilt angle would affect plating thickness. In the experiment, the plating thickness distribution at the time of changing theta whenever [ tilt-angle / of rust-like lower limit section 4a which is shown in drawing 3 and which goes away up current shield 4 ] was investigated in smooth side side 8a of stripe \*\* 8 shown in drawing 2 . The result is shown in drawing 4 . An axis of abscissa shows \*\*\*\* (the plating thickness measurement direction of drawing 2 ) of a metal strip object, and an axis of ordinate shows plating thickness (micrometer). In addition, although white swallowing up is drawn about all \*\*\*\*, about the black dot, the rectangular head, and the trigonum, the part converged on the straight line of 2-micrometer thick regularity is omitted.

[0016] This drawing shows that the include angle theta exactly good for middle exists since the thickness of the lower limit section becomes thin, if the thickness of the lower limit section becomes thick if theta becomes small whenever [ tilt-angle ], and theta becomes large whenever [ tilt-angle ] conversely. The include angle theta is 60-80 degrees, and it turned out that suitable thickness distribution can be acquired in the range. Moreover, the effectiveness was also actually checked. However, since it differs according to the class and plating conditions of a metal strip object, it cannot generally say which include angle of the above-mentioned range turns into optimal include angle. In addition, as a result of the time of theta= 90 degrees corresponding to the thing of a configuration conventionally and having effect with the bigger current electric shielding conditions at this time than the fine conditions of a plating liquid flow, upside plating thickness becomes low.

[0017] In order to determine whenever [ tilt-angle / of the optimal wedge-like lower limit section ] according to the class and plating conditions of a metal strip object, two or more up current shields which have theta in the wedge-like lower limit section whenever [ various tilt-angles ] are prepared, and it is possible to select the optimal thing out of it. However, in preparing two or more current shields for eye others, it is very uneconomical. Then, you may enable it to select a suitable include angle in drawing 3 by making removable lower limit section 4a of the current shield 4 by \*\*\*\* etc., and preparing only two or more kinds of lower limit sections.

[0018] Or as it advances further and is shown in drawing 5 , while making the lower limit section of the current shield 4 into hollow structure, it is made to carry out by enabling telescopic motion of a part of the board wall 12 adjustable [ of theta ] whenever [ tilt-angle ]. an include angle theta -- the case where he wants to enlarge -- a bay -- sigma1 only -- lengthening -- a ramp -- sigma2 only -- you make it shrunken ( drawing 5 (a)) on the contrary, the case where he wants to make an include angle theta small -- a bay -- sigma1 only -- it is shrunken -- making -- a ramp -- sigma2 only -- it is made to lengthen ( drawing 5 (b)) According to this, it can respond to change of plating conditions etc. in an instant.

[0019] Thus, although equalization of plating thickness can be attained if the lower limit section of an up current shield

is made into the shape of a wedge, it is also still more important for equalization of plating thickness to arrange an up current shield in a suitable location to a metal strip object. Drawing 6 enables it to have selected the current shields 4 and 4 to the metal strip object in the plating bath 1 in the suitable arrangement location by forming a delivery fixture 9 like a screw rod horizontally, attaching both the currents shields 4 and 4 in the middle of this delivery fixture 9, and operating the feed motors 10 and 10 covered with the raintight cover 11 prepared in both ends, in order to give a degree of freedom to the arrangement location of the up current shield 4. even if the class and plating conditions of a metal strip object change according to this -- base -- it can be made to correspond to the change quickly

[0020]

[Effect of the Invention] Since according to this invention the inclination was established in the up current shield and the lower limit section was made into the shape of a wedge, the plating thickness of a metal strip object can be equalized.

[0021] If it makes free especially adjustable [ of whenever / tilt-angle / of the lower limit section of an up current shield ], even if plating conditions differ, whenever [ suitable for the condition / optimal tilt-angle ] can be set up easily.

[0022] Moreover, since whenever [ tilt-angle / of the lower limit section of an up current shield ] was made into 60-80 degrees; the plating thickness of a metal strip object can be equalized further.

[0023] Moreover, since it enabled it to adjust the location to the metal strip object of an up current shield, even if plating conditions differ, the optimal current shield location suitable for the condition can be set up easily.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] The sectional view showing the configuration of the electroplating equipment by the example of this invention.

[Drawing 2] The sectional view of stripe \*\* for explaining a smooth side and convex side.

[Drawing 3] The important section expanded sectional view of the up current shield whose attachment and detachment of the lower limit section by this example were enabled.

[Drawing 4] Thickness distribution by the side of the smooth side of stripe \*\* when changing theta whenever [ tilt-angle ].

[Drawing 5] The expanded sectional view of the flexible mold lower limit section of the up current shield by this example.

[Drawing 6] The explanatory view of the migration device of the up current shield by this example.

[Drawing 7] The sectional view showing the configuration of the electroplating equipment by the conventional example.

[Description of Notations]

1 Plating Bath

3 Metal Strip Object

4 Up Current Shield

4a Lower limit section

5 Lower Current Shield

6 Plating Liquid

7 Hydraulic Nozzle

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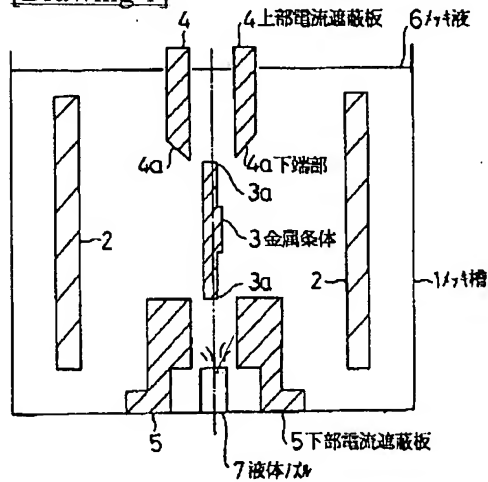
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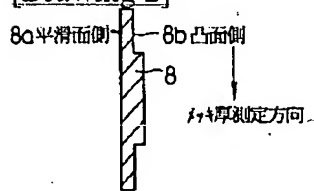
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DRAWINGS

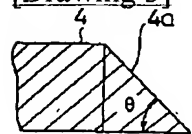
[Drawing 1]



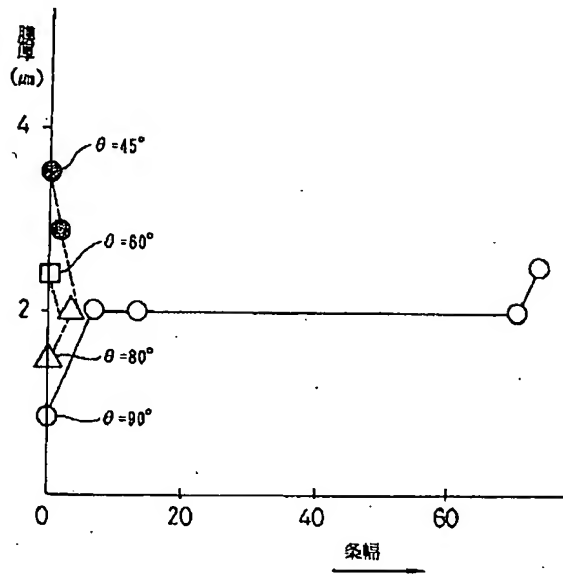
[Drawing 2]



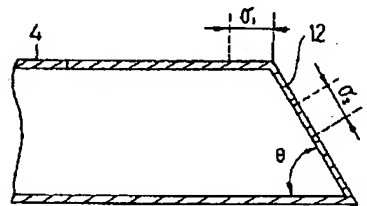
[Drawing 3]



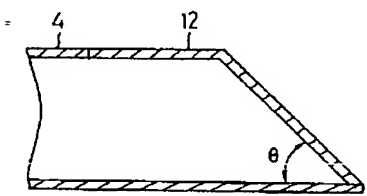
[Drawing 4]



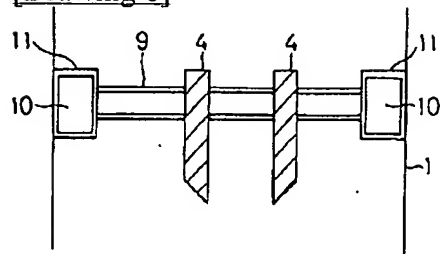
[Drawing 5]  
(a)



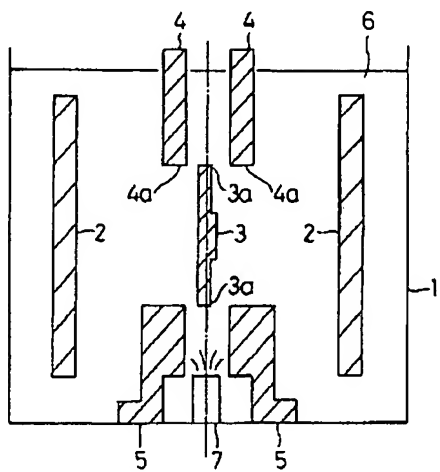
(b)



[Drawing 6]



[Drawing 7]



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